This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

1. (original) A MRAM construct, comprising a MRAM cell structure connected by a spin hold element to a spin filtering element.

2. (original) The MRAM construct of claim 1 wherein the MRAM cell structure comprises a GMR device.

3. (original) The MRAM construct of claim 1 wherein the MRAM cell structure comprises a MTJ device.

4. (original) The MRAM construct of claim 2 wherein the MRAM cell structure comprises at least two ferromagnetic layers separated by a conductor layer.

5. (original) The MRAM construct of claim 3 wherein the MRAM cell structure comprises at least two ferromagnetic layers separated by an insulator layer.

6. (original) The MRAM construct according to claim 1 wherein the spin filtering element includes a ferromagnetic material having a high magnetic polarization value.

7. (original) The MRAM construct according to claim 1 wherein the spin filtering element includes a Heusler alloy.

8. (original) The MRAM construct according to claim 7 wherein the Heusler alloy is a Mn based Heusler alloy.

9. (original) The MRAM construct according to claim 1 wherein the spin filtering element includes a Mn based Heusler alloy selected from the group consisting of NiMnSb and NiMnGa.

10. (original) The MRAM construct according to claim 7 wherein the Heusler alloy is an oxide based Heusler alloy.

11. (original) The MRAM construct according to claim 1 wherein the spin filtering element includes an oxide based alloy selected from the group consisting of Fe_3O_4 and CrO_2.

12. (original) The MRAM construct according to claim 1 wherein the spin filtering element includes a Mn based CMR material.

13. (original) The MRAM construct according to claim 12 wherein the spin filtering element includes a Mn based CMR material selected from the group consisting of $La_xSr_{1-x}MnO_3$ and $Pr_xCa_{1-x}MnO_3$.

14. (original) The MRAM construct according to claim 1 wherein the spin filtering element includes a Mn based ferromagnetic material.

15. (original) The MRAM construct according to claim 14 wherein the Mn based ferromagnetic material of the spin filtering element comprises NiMnGa.

16. (original) The MRAM construct according to claim 14 wherein the Mn based ferromagnetic material of the spin filtering element comprises NiMnSb.

17. (original) The MRAM construct according to claim 1 wherein the spin filtering element includes an oxide based ferromagnetic material.

18. (original) The MRAM construct according to claim 17 wherein the oxide based ferromagnetic material of the spin filtering element comprises Fe_3O_4.

19. (original) The MRAM construct according to claim 17 wherein the oxide based ferromagnetic material of the spin filtering element comprises CrO_2.

20. (original) The MRAM construct according to claim 1 wherein the spin hold element comprises a material having a high spin diffusion length.

21. (original) The MRAM construct according to claim 20 wherein the spin hold element comprises a material having a spin diffusion length at least about 100 nm.

22. (original) The MRAM construct according to claim 1 wherein the spin hold element comprises Bi.

23. (original) The MRAM construct according to claim 22 wherein the spin hold element comprises single-crystal Bi.

24. (original) The MRAM construct according to claim 22 wherein the spin hold element comprises poly-crystal Bi.

25. (original) The MRAM construct according to claim 1 wherein the spin hold element and the spin filtering element are adjacent layers in the MRAM cell structure, and the spin hold element comprises a conductive metal layer having a thickness less than the electron mean free path in the metal.

26. (original) The MRAM construct of claim 25 wherein the metal of the spin hold conductive metal layer is Cu.

27. (original) The MRAM construct of claim 26 wherein the spin hold Cu layer has a thickness in the range about 4 nm to about 10 nm.

28. (original) The MRAM construct of claim 25 wherein the metal of the spin hold conductive metal layer is Al.

29. (original) The MRAM construct of claim 28 wherein the spin hold Al layer has a thickness in the range about 4 nm to about 5 nm.

30. (original) The MRAM construct according to claim 1 wherein the MRAM cell structure comprises a MTJ system having first and second ferromagnet layers separated by a thin insulator, the ferromagnet layers having different coercivity fields.

31. (original) The MRAM construct according to claim 30 wherein the insulator comprises a material selected from the group consisting of Al_2O_3, AlN, AlON, Ga_2O_3, $SrTiO_3$, HFO_2, Ta_2O_5.

32. (original) The MRAM construct according to claim 30 wherein the first ferromagnet layer comprises a material different from that of the second ferromagnet layer.

33. (original) The MRAM construct according to claim 30 wherein the first ferromagnet layer and the second ferromagnet layer each comprise a material selected from the group consisting of a 3d transition ferromagnet material.

34. (original) The MRAM construct of claim 33 wherein the 3d transition ferromagnetic material is selected form the group consisting of Fe, Co, CoFe and CoFeNi.

35. (original) The MRAM construct of claim 30 wherein the first ferromagnet layer and the second ferromagnet layer each comprise a Heusler alloy.

36. (original) The MRAM construct of claim 35 wherein the Heusler alloy comprises a material selected from the group consisting of $La_xSr_{1-x}MnO_3$ and $Pr_xCa_{1-x}MnO_3$.

37. (original) The MRAM construct of claim 30 wherein the first ferromagnet layer and the second ferromagnet layer each comprise an oxide based alloy.

38. (original) The MRAM construct of claim 37 wherein the oxide based alloy is selected from the group consisting of Fe_3O_4 and CrO_2.

39. (original) The MRAM construct according to claim 1 wherein the MRAM cell structure comprises a GMR system having first and second ferromagnet layers separated by a thin conductor, the ferromagnet layers having different coercivity fields.

40. (original) The MRAM construct according to claim 30 wherein the conductor comprises a material selected from the group consisting of Cu, Ag, Au, Ru, Cr.

41. (original) The MRAM construct according to claim 39 wherein the first ferromagnet layer comprises a material different from that of the second ferromagnet layer.

42. (original) The MRAM construct according to claim 39 wherein the first ferromagnet layer and the second ferromagnet layer each comprise a material selected from the group consisting of a 3d transition ferromagnet material.

43. (original) The MRAM construct of claim 42 wherein the 3d transition ferromagnetic material is selected form the group consisting of Fe, Co, CoFe and CoFeNi.

44. (original) The MRAM construct of claim 39 wherein the first ferromagnet layer and the second ferromagnet layer each comprise a Heusler alloy.

45. (original) The MRAM construct of claim 43 wherein the Heusler alloy comprises a material selected from the group consisting of $La_xSr_{1-x}MnO_3$ and $Pr_xCa_{1-x}MnO_3$.

46. (original) The MRAM construct of claim 39 wherein the first ferromagnet layer and the second ferromagnet layer each comprise an oxide based alloy.

47. (original) The MRAM construct of claim 46 wherein the oxide based alloy is selected from the group consisting of Fe_3O_4 and CrO_2.

48. (original) The MRAM construct according to claim 30 wherein the MRAM cell structure comprises a spin-valve MTJ.

49. (original) The MRAM construct according to claim 32 wherein the spin-valve MTJ comprises a free ferromagnetic layer and a pinned ferromagnetic layer and a pinning layer.

50. (original) The MRAM construct according to claim 49 wherein the pinning layer comprises an antiferromagnetic material.

51. (original) The MRAM construct according to claim 49 wherein the pinning layer comprises a MN based material.

52. (original) The MRAM construct according to claim 51 wherein the Mn based material is selected from the group consisting of IrMn and FeMn.

53. (original) The MRAM construct according to claim 49 wherein the pinning layer comprises a synthetic antiferromagnetic multilayer.

54. (original) The MRAM construct according to claim 53 wherein the synthetic antiferromagnetic multilayer comprises layers selected from the group consisting of CoFe/Ru/CoFe and Co/Ru/Co.

55. (original) The MRAM construct according to claim 49 wherein the pinning layer comprises a mixed multilayer comprising a synthetic antiferromagnetic material and an antiferromagnetic material.

56. (original) The MRAM construct according to claim 55 wherein the mixed multilayer comprises layers selected from the group consisting of IrMn/CoFe/Ru/CoFe and FeMn/Co/Ru/Co.

57. (original) The MRAM construct according to claim 49 wherein the pinning layer comprises a permanent magnet material.

58. (original) The MRAM construct according to claim 49 wherein the permanent magnet material is selected from the group consisting of SmCo and SmFeCo.

59. (original) The MRAM construct according to claim 30 wherein the MRAM cell structure comprises a pseudo-spin valve MTJ.

60. (original) The MRAM construct according to claim 59 wherein the MRAM cell structure comprises a soft ferromagnetic layer and a hard ferromagnetic layer, wherein the coercivity of the hard ferromagnetic layer is greater than the coercivity of the soft ferromagnetic material.

61. (original) The MRAM construct of claim 60 wherein the soft ferromagnetic layer comprises a material selected from the group consisting of NiFe, Co and NiFeCo.

62. (original) The MRAM construct of claim 60 wherein the hard ferromagnetic layer comprises a material selected from the group consisting of CoFe and Co.

63. (original) The MRAM construct of claim 30 wherein the MRAM cell structure comprises a MTJ comprising a granular material.

64. (original) The MRAM construct of claim 63 wherein the distance between grains of ferromagnetic material is in a range about 100 Å to about 300 Å.

65. (original) The MRAM structure of claim 63 wherein the granular material is selected from the group consisting of Fe-Al_2O_3, Fe-SiO_2, Co-SiO_2.

66. (original) The MRAM construct according to claim 39 wherein the MRAM cell structure comprises a spin-valve GMR.

67. (original) The MRAM construct according to claim 41 wherein the spin-valve GMR comprises a free ferromagnetic layer and a pinned ferromagnetic layer and a pinning layer.

68. (original) The MRAM construct according to claim 67 wherein the pinning layer comprises an antiferromagnetic material.

69. (original) The MRAM construct according to claim 67 wherein the pinning layer comprises a MN based material.

70. (original) The MRAM construct according to claim 69 wherein the Mn based material is selected from the group consisting of IrMn and FeMn.

71. (original) The MRAM construct according to claim 67 wherein the pinning layer comprises a synthetic antiferromagnetic multilayer.

72. (original) The MRAM construct according to claim 71 wherein the synthetic antiferromagnetic multilayer comprises layers selected from the group consisting of CoFe/Ru/CoFe and Co/Ru/Co.

73. (original) The MRAM construct according to claim 67 wherein the pinning layer comprises a mixed multilayer comprising synthetic antiferromagnetic material and an antiferromagnetic material.

74. (original) The MRAM construct according to claim 73 wherein the mixed multilayer comprises layers selected from the group consisting of IrMn/CoFe/Ru/CoFe and FeMn/Co/Ru/Co.

75. (original) The MRAM construct according to claim 67 wherein the pinning layer comprises a permanent magnet material.

76. (original) The MRAM construct according to claim 67 wherein the permanent magnet material is selected from the group consisting of SmCo and SmFeCo.

77. (original) The MRAM construct according to claim 39 wherein the MRAM cell structure comprises a pseudo-spin valve GMR.

78. (original) The MRAM construct according to claim 77 wherein the MRAM cell structure comprises a soft ferromagnetic layer and a hard ferromagnetic layer, wherein the coercivity of the hard ferromagnetic layer is greater than the coercivity of the soft ferromagnetic material.

79. (original) The MRAM construct of claim 78 wherein the soft ferromagnetic layer comprises a material selected from the group consisting of NiFe, Co and NiFeCo.

80. (original) The MRAM construct of claim 78 wherein the hard ferromagnetic layer comprises a material selected from the group consisting of CoFe and Co.

81. (original) The MRAM construct of claim 39 wherein the MRAM cell structure comprises a GMR comprising a granular material.

82. (original) The MRAM construct of claim 81 wherein the distance between grains of ferromagnetic material is in a range about 100 Å to about 300 Å.

83. (original) The MRAM structure of claim 81 wherein the granular material is selected from the group consisting of Fe-Al_2O_3, Fe-SiO_2, Co-SiO_2.

84. (original) The MRAM structure of claim 39 wherein the GRM system comprises a periodic multilayer structure, alternating a ferromagnetic metal with a nonferromagnetic material.

85. (original) The MRAM structure of claim 84 wherein the multilayer structure comprises $(NiFe/Cu)_n$.

86. (original) An MRAM construct comprising a plurality of MRAM cell structures, and including a spin filtering element connected to the plurality of MRAM cell structures by a spin hold wire adjacent a first ferromagnetic layer on the MRAM cell structures.

87. (original) An MRAM construct comprising a plurality of MRAM cells, each MRAM cell comprising a MRAM cell structure, a spin hold layer adjacent the MRAM cell structure, and a spin filtering layer adjacent the spin hold layer.

88. (original) The MRAM construct of claim 86 wherein the spin hold wire comprises Bi.

89. (original) The MRAM construct of claim 87 wherein the spin hold layer comprises Bi.

90. (original) The MRAM construct of claim 87 wherein the spin hold layer comprises a layer of a conductive metal, the layer having a thickness less than the electron mean free path in the metal.

91. (original) The MRAM construct of claim 90 wherein the conductive metal layer comprises Cu.

92. (original) The MRAM construct of claim 91 wherein the Cu layer has a thickness in the range about 4 nm to about 10 nm.

93. (original) The MRAM construct of claim 90 wherein the layer comprises Al.

94. (original) The MRAM construct of claim 93 wherein the Al layer has a thickness in the range about 4 nm to about 5 nm.

95. (original) A MRAM array comprising the MRAM construct of claim 1.